WHAT ARE SCIENTIFICALLY BASED RESEARCH STRATEGIES?

NCLB

Overview

Educational research is the formal, systematic application of the scientific method to the study of educational problems. Stated another way, educational research is a careful and diligent search for an answer. Not all research is the same, nor is all research scientifically based. This document includes information to help schools and districts determine if strategies and programs are based on scientifically based research. This is a condensed version of information provided by the National Clearinghouse for Comprehensive School Reform (NCCSR) and the American Institute for Research (AIR). NCCSR developed a process to analyze research studies and has very detailed information on the web. Schools are encouraged to review the information on the NCCSR web site at: www.goodschools.gwu.edu. Schools can send questions about the research basis of reform strategies being considered to: AskNCCSR@goodschools.gwu.edu. NCCSR will find the available research on particular strategies and make some comments about the quality of the research. Schools are also encouraged to review information from AIR. The AIR developed a process for interpreting the research findings and judging the strength of the evidence for a particular instructional practice or reform model. The web site for AIR is: www.air-dc.orgT. Much of the information included in this document comes from these resources.

NCLB Definition

The definition for scientifically based research found in Title IX, Section 9101 of the No Child Left Behind Act (NCLB) states:

The term scientifically based research means research that:

- involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs
- employs systematic, empirical methods that draw on observation or experiment; involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn
- relies on measurements or observational methods that provide reliable and valid data across evaluators and observers, across multiple measurements and observations, and across studies by the same or different investigators
- is evaluated using experimental or quasi-experimental designs in which individuals, entities, programs, or activities are assigned to different conditions and with appropriate controls to evaluate the effects of the condition of interest, with a preference for random-assignment experiments, or other designs to the extent that those designs contain within-condition or across-condition controls; ensures that experimental studies are presented in sufficient detail and clarity to allow for replication or, at a minimum, offer the opportunity to build systematically on their findings
- has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review

Components of Research Studies

The purpose of research is to understand a particular problem or the impact of an intervention. Interventions include the implementation of a program and/or practice. Each research study contains six specific components.

1. Abstract – 100-500 word summary of the study
2. Objective – describes what the researchers are trying to discover and includes the formal statement of the research question or hypothesis to be empirically investigated
3. Research Procedures/Methodology – identifies the research subjects; how data were measured and collected; and the methods of analysis used to reach the conclusions presented

4. Findings – provides the raw data and the analysis of the data
5. Discussion section – provides the interpretation of the research findings
6. Conclusion – focuses on addressing the research question, hypothesis, or problem statement and asks if the study met the stated purpose

Analyzing Components of Research Studies
How researchers put components together is what determines the quality of a study and will determine how schools should read and examine research. It is important to recognize that different parts of a study will be relevant or applicable to varying degrees depending upon the questions the school has and where it is in the process of comprehensive school improvement.

1.) Abstract
The abstract is the first component a school should look at to determine the relevance of the study for the school. If the study is on a "math program" but the school's need is reading, one would know immediately that this study is not appropriate for the school. If the research design is not very rigorous, it may give an indication as to whether the study will really help to determine the quality of a program or practice for the school.

2.) Objective (Problem/Purpose)
This component of the research study helps the school determine what the study is about and describes what the researchers are trying to discover. It includes a research question or hypothesis and the purpose of the study. There are three different reasons to conduct a study:

- To test a theory
- To assess the implementation or replicability of a reform practice or program
- To test the impact or effectiveness of an intervention practice or program

3.) Research Procedures/Methodology
This component of the research study will help the school assess the quality or rigor of the study. The methodology should clearly identify the composition of the research (subject sample), the research design (how data were measured and collected), and the methods of analysis used to reach the conclusions presented.

When a school looks at the research *subjects*, the school should analyze the appropriateness of the subjects to determine if they are the best possible group to study to answer the research question. Also, the school should examine the number of subjects involved as the composition and the number of subjects will affect the quality and applicability of the study.

The research procedure also describes the research *design* and how the particular design is best suited to test the problem statement. The link between the research question and the method must be clearly indicated and justified by the researcher. No matter what method of analysis is used, the researchers must provide justification for using a particular method. Research designs fall into two major categories:

- Quantitative – the collection of numerical data in order to describe, explain, predict, and/or control a phenomenon of interest. The data analysis is mainly statistical and relies predominantly on a deductive approach. Quantitative research begins with a theory about a relationship that suggests certain data to collect. The data are collected and analyzed. Findings will either refute or support the theory. There are three types of quantitative research that serve a particular purpose and are employed based on what a researcher wants to know:
  - Descriptive studies - report the way things are; are used to summarize, organize, and simplify data

- Experimental studies - test hypotheses by observing conditions or characteristics to show that changes in one are caused by changes in the other, controls all conditions, measures the change or difference that occurs as a result of manipulating an intervention or variable, and must include a pre-test and a post-test to measure these differences
- Quasi-experimental - a form of experimental research where the researcher cannot control at least one of the three elements of the design (environment, assignment to experimental and control groups, intervention)

- Qualitative – the research is actually multi-method in focus and involves an interpretive, naturalistic approach to its subject matter. Researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of meanings people bring to them. Qualitative inquiry often starts out with "how" or "what" questions and tries to make sense of and describe what is going on. Qualitative research collects observations and is descriptive. There are three types of qualitative research:
  - Historical - the systematic collection and evaluation of data related to past occurrences in order to describe the causes, effects, and trends of events that may help to explain present circumstances or anticipate future events
  - Ethnographic - the collection of extensive narrative data over an extended period of time in a natural setting
  - Case studies - an in-depth examination of one particular entity or case over time

4.) Findings

This component will provide the raw data and the analysis of the data. The results will indicate whether the research is "statistically significant," meaning the researchers found that the program or practice has made a difference and it was not by chance. It is important to look for findings that are statistically significant, that tells the school the treatment had an effect.

5.) Discussion Section

This component provides the interpretation of the research findings. The researcher identifies what can and cannot be concluded from the research and addresses the possible implications of the results. Researchers also connect the various aspects of their analysis, showing commonalities across groups, uniqueness where it exists, and inconsistencies in the results. Researchers should provide an honest appraisal of their work. They should also identify the limits of their findings, drawing attention to what is missing due to design or data analysis. Researchers should connect their work to the larger research world by highlighting what is and is not consistent with prior research.

6.) Conclusion

This component should provide much of the information the school needs to glean from research. It may be easier to review this section for most of the information the school needs about the study. Ultimately, what the school should look for in this section is whether the program or practice under investigation improved student achievement and, if it did, what conditions are necessary to reproduce those results. The conclusion should explain not only the study findings, but also the implications of the findings.

Judging the Quality of a Research Based Study

Schools may find all types of research useful in making decisions. However, in planning for Comprehensive School Reform, Title I, Part A or Title V, Part A funding, NCLB specifies that the research must demonstrate adequate proof of success and must come from *quantitative research studies* using an *experimental or quasi-experimental design*.

To assist schools in analyzing research, NCCSR has established two levels (gold and silver) of standards for determining if a research study is scientifically based. Research of all kinds can help inform the school's work, whether or not it is seeking federal and state funds. Not all studies will meet the criteria established in NCLB (the gold or silver standards) for funding purposes. However, the school

could use these studies to help decide which programs are most appropriate for the culture and climate of the school and implement them through other funding sources.

Gold Standard Research

- Experimental research
- The intervention (program/practice) studied and the outcome is clearly established (causality between treatment and student achievement/the practice works)
- Must control **all** conditions (environment, random assignment of subjects and intervention)

Silver Standard Research

- Quasi-experimental research
- Cannot determine causality
- Controls **all but one** of the conditions (environment, random assignment of subjects and intervention)

Evidence of Effects

Determining the gold or silver standard of a research study meets one of the six criteria in the NCLB definition of scientifically based research (uses an experimental or quasi-experimental design). The school needs to judge the strength of the evidence for an instructional practice or reform model using all six criteria. Also, to be scientifically based, at least four gold and/or silver standard research studies for one instructional strategy or reform model should be reviewed. Schools should refer to the *Determining Scientifically Based Status* chart to assist in determining scientifically based research status.

Following is information regarding five of the six criteria outlined in NCLB. Since the criterion regarding experimental or quasi-experimental design has been discussed extensively in this document, it is not listed below.

- Employs systematic and empirical methods – to meet this criteria, researchers must establish a clear and justifiable link between the research question and the method employed to answer it
- Uses rigorous data analyses – to meet this criteria, the data must be adequately analyzed so the conclusions can be justified and usually includes statistical analysis of student achievement data and statistically significant findings
- Relies on measurements that provide reliable and valid data – to meet this criteria, the data is considered **reliable** if a measure yields consistent results when taken under similar conditions and **valid** if a measure accurately predicts what it is designed to predict
- Provides detailed results that allow for replication – to meet this criteria, there must be a clear, detailed description of the method and have enough information to allow a different researcher to conduct the same study
- Results have been subjected to scrutiny – to meet this criteria, the study must have been reviewed by independent experts or accepted in a peer reviewed journal

JUDGING THE QUALITY OF A SCIENTIFICALLY BASED RESEARCH STUDY

DETERMINING SCIENTIFICALLY BASED STATUS

This flow chart demonstrates the process for determining the scientifically based status of an instructional practice or reform model. At least four high or reasonable quality research studies should be used in making these decisions. Note: If any box in the chart with a (*) is answered **"no"**, the research study should **not** be considered scientifically based.

Yes to all **Yes to all but one**

Yes **No**

Yes

Yes

Yes

Yes

Yes